CLAIMS

1. A method for detecting misfiring in an internal combustion engine (1) by analysing the angular acceleration (acc) of the drive shaft (4), in which the value (acc) of the angular acceleration of the drive shaft (4) is estimated at predetermined angular positions of this drive shaft (4), the absolute value (acc) of the angular acceleration of the drive shaft (4) is compared with a predetermined threshold value (S), and the presence of a misfire is detected if the absolute value (acc) of the angular acceleration of the drive shaft (4) is greater than the predetermined threshold value (S), characterised in that when the presence of a misfire is detected, i.e. when an absolute value (acc) of the angular acceleration of the drive shaft (4) exceeds the threshold value (S), a set of values (acc) of the angular acceleration of the drive shaft (4) subsequent to the value (acc) of the angular acceleration of the drive shaft (4) at which the misfire has been detected is filtered to eliminate the oscillation component generated by the misfire with respect to the value (acc) of the angular acceleration of the drive shaft (4), only the filtered values (acc) of the angular acceleration of the drive shaft (4) being compared with the threshold value (S) to detect the presence of any further misfires subsequent to the

misfire detected.

2. A method as claimed in claim 1, in which the values (acc) of the angular acceleration of the drive shaft (4) subsequent to the value (acc) of the angular acceleration of the drive shaft (4) at which the misfire has been detected are filtered by algebraically adding to these values a corresponding set of correction values obtained at the design and development stage of the engine (1) by analysing the oscillation generated by a misfire with respect to the value (acc) of the angular acceleration of the drive shaft (4).

3. A method as claimed in claim 2, in which the correction values are calculated by subtracting a corresponding set of values (acc) of the angular acceleration of the drive shaft (4) in the presence of a misfire from a set of values (acc) of the angular acceleration of the drive shaft (4) in standard conditions.

4. A method as claimed in claim 2, in which the correction values are variable as a function of the current engine point.

5. A method as claimed in claim 4, in which, at the design stage of the engine (1), a plurality of salient engine points are identified, at each of which the corresponding sample set of correction values is calculated, and during the normal operation of the engine (1), the set of correction values for the current

engine point is calculated by interpolating the sample sets of correction values.

6. A method as claimed in claim 4, in which, at the design stage of the engine (1), a plurality of salient engine points are identified, at each of which the corresponding sample set of correction values is calculated, and a single standard reference set independent from the engine point is calculated from the sample sets of correction values, and during the normal operation of the engine (1), the set of correction values for the current engine point is calculated from the standard reference set.

7. A method as claimed in claim 6, in which the set of values (acc) of the angular acceleration of the drive shaft (4) and the set of correction values are expressed as angular acceleration of the drive shaft (4) as a function of the angular position of the drive shaft (4), the standard reference set being expressed as a ratio between angular acceleration of the drive shaft (4) and engine load (1) as a function of time.

8. A method as claimed in claim 7, in which the engine load (1) is indicated by the flow of fresh air supplied to the engine (1).

9. A method as claimed in claim 1, in which a set of eight values (acc) of the angular acceleration of the drive shaft (4) are filtered from the value (acc) of the angular acceleration of the drive shaft (4) at which the

misfire has been detected.

10. A method as claimed in claim 1, in which the threshold value (S) for the detection of the misfire is a function of the current engine point.

11. A method as claimed in claim 1, in which, for each complete rotation of the drive shaft (4), as many values (acc) of the angular acceleration of the drive shaft (4) are estimated as there are cylinders (2) performing combustion during a complete rotation of the drive shaft (4).

12. A method as claimed in claim 1, in which, in each complete rotation of the drive shaft (4), as many angular measurement sections having the same amplitude are identified as there are cylinders (2) performing combustion during a complete rotation of the drive shaft (4), the time taken by the drive shaft (4) to travel each angular measurement section being measured, and the value (acc) of the angular acceleration of the drive shaft (4) at the ith instant being calculated by applying the following formula:

$$acc_i = \frac{T_{i+1} - T_i}{T_i^3}$$

in which:

acc_i is the angular acceleration of the drive shaft (4) at the ith instant;

T_{i+1} is the time taken by the drive shaft (4) to

travel the (i+1)th angular measurement section;

T_i is the time taken by the drive shaft (4) to travel the ith angular measurement section.

13. A method as claimed in claim 12, in which the time taken by the drive shaft (4) to travel each angular measurement section is measured using the signal supplied by the phonic wheel (5) which is provided with a disc having 60 teeth (6), each angular measurement section having an angular amplitude equal to a number of teeth (6) of the phonic wheel (12) of between 3 and 12.

14. A method as claimed in claim 12, in which each angular section is at least partially superimposed with respect to the expansion stroke of a respective piston (3).

15. A method as claimed in claim 12, in which each angular section substantially coincides with the expansion stroke of a respective piston (3).